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Test 545: Minneapolis-Moline Moel GB LPG

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The Experiment Station
University of Nebraska College of Agriculture
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering
Dates of test: May 31 to June 7, 1955
Manufacturer: MINNEAPOLIS-MOLINE COMPANY,
MINNEAPOLIS, MINNESOTA
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 545

MINNEAPOLIS-MOLINE GB LPG

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury		
		Gal per hour	Hp-hr per gal	Lb per hp-hour		Cooling med	Air			
TEST B—100% MAXIMUM LOAD—TWO HOURS										
70.55	1300	7.538	9.36	0.454	0.00	176	84	28.808		
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR										
68.48	1300	6.922	9.89	0.430	0.00	173	82	28.825		
TEST D—RATED LOAD—ONE HOUR										
63.75	1299	6.586	9.68	0.439	0.00	170	82	28.850		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
63.78	1300	6.593	9.67	0.439	...	170	81		
1.31	1354	2.118	0.62	6.870	...	155	80		
32.99	1338	4.482	7.36	0.577	...	161	80		
66.93	1263	6.727	9.95	0.427	...	169	80		
16.72	1351	3.296	5.07	0.838	...	160	79		
48.58	1316	5.513	8.81	0.482	...	164	79		
38.39	1320	4.788	8.02	0.530	0.00	163	80	28.850		
TORQUE (At Dynamometer)										
Eng rpm	1298	1224	1150	1068	991	914	846	767	698	630
Lb-ft	441.9	440.1	438.4	440.5	441.0	434.0	430.9	430.5	432.3	437.5
Dyn rpm	827	780	732	680	630	582	539	489	445	402

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury
					Gal per hour	Hp-hr per gal	Lb per hp-hr		Cool- ing med	Air	
TEST H—RATED LOAD—TEN HOURS—3rd Gear											
49.68	4350	4.28	1300	6.10	6.022	8.25	0.515	0.00	167	76	28.756
TEST F—100% MAXIMUM LOAD											
62.14	5557	4.19	1302	8.17	3rd Gear.....				172	81	28.700
TEST G—OPERATING MAXIMUM LOAD											
43.62	7094	2.31	1302	16.44	1st gear (part throttle).....				163	80	28.750
59.86	6387	3.51	1301	9.90	2nd gear.....				162	67	28.750
61.12	5434	4.22	1302	7.63	3rd gear.....				163	65	28.750
61.23	3684	6.23	1300	5.02	4th gear.....				161	68	28.760
52.99	1322	15.03	1303	1.56	5th gear.....				162	68	28.760
TEST J—OPERATING MAXIMUM LOAD											
49.34	4640	3.99	1304	13.23	3rd gear (part throttle).....				164	80	28.830

TIRES, WHEELS AND WEIGHT Tests F, G, & H

Rear wheels		
Type	Cast iron	Cast iron
Liquid ballast	934 lb each	None
Added cast iron	1200 lb each	None
Rear tires		
No. and size	Two 15-34	Two 15-34
Ply	6	6
Air pressure	16 lb	12 lb
Front wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	None	None
Added cast iron	156 lb each	None
Front tires		
No. and size	Two 7.50-18	Two 7.50-18
Ply	4	4
Air pressure	28 lb	28 lb
Height of drawbar	18½ inches	19 inches
Static weight		
Rear end	9390 lb	5123 lb
Front end	2530 lb	2218 lb
Total weight as tested with operator		
	12,095 lb	7506 lb

FUEL, OIL and TIME Commercial Propane Octane No. 100 (rating taken from oil company's typical inspection data): weight per gallon 4.25 lb Oil SAE 30 to motor 2.171 gal drained from motor 2.061 gal Total time motor was operated 37½ hours.

CHASSIS Type Standard Serial No. 08900527 Tread width rear 62" front 54¼" Wheel base 82½" Hydraulic control system direct engine drive Advertised speeds mph first 2.7 second 3.8 third 4.4 fourth 6.3 fifth 14.7 reverse 2.1 Belt pulley diam 16" face 7" rpm 741 Belt speed 3104 fpm Clutch twin disc clutch operated by hand lever Seat pressed steel mounted on coil spring with snubber Brakes disc brakes operated by two foot pedals Equalized no Power take-off conventional type.

ENGINE Make Minneapolis-Moline Type 4-cylinder vertical Serial No. 02006907 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 4⅞" x 6" Rated rpm 1300 Compression ratio 8.37 to 1 Displacement 403.2 cu in Port diameter valves inlet 1½" exhaust 1⅜" Governor variable speed centrifugal Carburetor size 1¼" Ignition system battery Starting system 12 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable waste cartridge Cooling medium temperature control thermostat.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, and J were made with an operating setting of the carburetor (selected by the manufacturer) of 96.8% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" HG)	66.08	74.95
2. Observed maximum horsepower (tests F and B)	62.14	70.55
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower ratings (formerly ASAE and SAE ratings)	49.56	63.71

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 545.

L. F. LARSEN
Engineer-In-Charge

C. W. SMITH
L. W. HURLBUT
F. D. YUNG
Board of Tractor
Test Engineers

EXPLANATION OF TEST REPORT

TEST A: The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

BELT HORSEPOWER TESTS

TEST B: The throttle valve is held wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

TEST C: For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is held wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors, which have an altogether different fuel system.

TEST D: The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

TEST E:

Varying load serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each: rated load, no load, $\frac{1}{2}$ rated load, maximum load at wide open throttle valve, $\frac{1}{4}$ and $\frac{3}{4}$ rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

Torque, lb-ft at dynamometer, is obtained with wide open throttle and sufficient load is applied to give several readings.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. All tests are made on the same dirt test course which is maintained by grading, sprinkling and rolling

so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

TEST F: A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

TEST G: Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

TEST J: The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

TEST K: Similar to test J except that the smallest tires and lightest wheels offered by the manufacturer are used.

